

REMARKS

Claims 1-6, as amended and new claims 11-24 appear in this application for the Examiner's review and consideration. Claims 7-10 have been cancelled without prejudice to applicants' rights to file a divisional application for the subject matter of those claims. Claims 1, 3 and 6 have been amended. Claim 1 has been amended to more distinctly claim the invention as explained in detail below, and consequently claim 6 has been amended. Claim 3 has been amended to replace "further comprising" with --wherein-- to correct a clerical error. New claims 11-24 have been added to cover preferred embodiments of the invention. These claims are supported by the original claims and by the specification on the last 2 paragraphs of page 6. No new matter has been added, so these claim changes and additions should be entered at this time. .

The following sections set forth below are presented in the same order as that of the Action of August 17, 2004 for ease of reference.

Election/Restrictions

Restriction to either group I claims 1-6 or to group II claims 7-10 has been required, and the applicant hereby elects to prosecute the group I claims. Consequently, claims 7-10 have been canceled without prejudice herein.

Claim Rejections under 35 U.S.C. §112

Claims 1-6 were rejected under the first paragraph of 35 U.S.C. §112 for allegedly failing to enable one skilled in the art to make and/or use the invention with regard to substrates other than silicon. The applicant respectfully disagrees. In particular, the application specifically recites that, although the described embodiment concerns silicon wafers, the method as recited in claim 1 could be applied to any polished surfaces of metals, semiconductors, and non-conductive materials which are bondable (see page 6, lines 28-30). It is respectfully asserted that, in view of the specification and figures, one skilled in the art would indeed be able to practice the invention commensurate with the scope of claim 1.

Claims 1-6 were also rejected for allegedly being indefinite because it is unclear how the adhesive surface is produced on the substrate. The applicants respectfully traverse this rejection, as it is clear from the application that an adhesive surface is provided by

performing the steps of the current inventive method. In particular, after the surface is treated by wet chemical etching, the etched surface is brought directly into contact with a gaseous ozone atmosphere. The ozone reacts with the hydrogen on the wafer surface to form silanol sites on the surface (see page 6, lines 15-19 and Fig. 5 of the application). As a result of the process recited in claim 1, an adhesive surface is provided, for example, for bonding with another wafer by applying pressure (page 6, lines 20-25 and Fig. 6).

In view of the above remarks, the applicant respectfully requests withdrawal of all of the 35 U.S.C. §112 rejections of the claims.

Claim Rejections under 35 U.S.C. §102(e)

Claims 1-5 were rejected for allegedly being anticipated by published U.S. application to Wu et al., US2003/0087532 ("Wu").

Claim 1 has been amended, and recites a method for producing an adhesive surface on a substrate that includes treating the surface by wet chemical etching to remove an oxide layer and to provide a hydrophobic surface, and directly exposing the etched hydrophobic surface to a gaseous ozone atmosphere within a closed container to provide a dry hydrophilic surface. Support for these changes can be found, for example, on page 6, lines 15-18, on page 5, lines 16-18, and in Figs. 1 and 5. No new matter has been added.

In contrast, Wu pertains to a methodology for patterned oxide etching and subsequent removal of the patterned photoresist (see paragraph 0009). Wu teaches to use ozone to remove the photoresist pattern during a stripping step, and in a subsequent step to form a second oxide layer (see paragraphs 13 and 14). Wu fails to teach or suggest to directly expose the etched hydrophobic surface to a gaseous ozone atmosphere within a closed container to provide a dry hydrophilic surface, as recited in claim 1. Such a technique is advantageous because it minimizes the chances of recontamination of the surface, and because it results in an adhesive surface having a reduced particle concentration in comparison to a hydrophilic wafer surface produced in a wet manner (see application, page 3, lines 24-27). Thus, the applicants respectfully assert that claim 1 is not anticipated. Claims 2-5 depend on claim 1, and consequently these claims also are not anticipated.

In view of the above amendments and remarks, the applicant respectfully requests withdrawal of the 35 U.S.C. §102(e) rejection of claims 1-5.

Claim Rejections under 35 U.S.C. §103

Claim 6 was rejected for allegedly being unpatentable over Wu in view of Konishi et al, U.S. Patent No. 6,227,212 ("Konishi").

Konishi discloses a semiconductor workpiece cleaning method and apparatus, that includes treating a wafer in a HF solution and then exposing it to a controlled atmosphere. Konishi teaches to fill a chamber with the HF solution to remove an oxide film, and then to supply pure water for rinsing. After the chamber is filled with pure water, a drying process is started that includes using isopropyl alcohol vapor (IPA) as the water is drained. After the water has been completely drained from the chamber, a nitrogen gas (N₂) is supplied to purge the IPA vapor. This ensures that the gas and the liquid can be separated from each other during drying such that the wafer can be cleaned and dried without forming any water mark thereon (see col. 5, lines 18-50 of Konishi). Thus, Konishi does not suggest or teach to expose the wafer to an ozone atmosphere, and does not provide a hydrophilic surface as recited in claim 1.

Furthermore, Konishi fails to remedy the deficiencies of Wu explained above. In particular, Konishi does not suggest or teach the step of directly exposing the etched hydrophobic surface to a gaseous ozone atmosphere. In view of the above comments, the applicants respectfully assert that claim 1 is patentably distinct over Konishi and Wu, whether taken alone or in combination. Since claim 6 depends upon claim 1, it is patentably distinct from Konishi and Wu for at least the same reasons. Thus, the applicant respectfully requests withdrawal of the 35 U.S.C. §103 of claim 6.

The New Claims

Claims 16-19 are similar to claims 1-6 and are patentable for the same reasons presented above with regard to the patentable distinctiveness of those claims over the cited references.

Claims 11 and 23 have been added to recite that the substrate is a silicon wafer. Such a claim is supported, for example, on page 5, lines 27-28. The feature recited in these claim is further distinguishable from the cited references so that these claims are allowable. Claims 12 and 24 recite that the substrate is metal, a material that is not mentioned in the cited references.

Claims 13-15 and 20-22 recite bonding of one substrate to another, followed by annealing, preferably at certain temperatures, to increase bonding strength. These claims are further patentable over the cited references, for example, since neither reference discloses these steps.

The prior art made of record but not relied upon has not been discussed herein, as none of those references were applied to any of the claims.

Conclusion

In view of the above amendments and remarks, the applicant respectfully requests withdrawal of all of the 35 U.S.C. §§112, 102(e) and 103(a) rejections of the claims. The applicant also respectfully submits that the entire application is in condition for allowance, early notice of which would be appreciated. Should the Examiner not agree that all pending claims are allowable, then a personal or telephonic interview is respectfully requested to discuss any remaining issues and expedite the eventual allowance of these claims.

Respectfully submitted,

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